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High Performance Enclosure Strategies: Part I, Existing Home

Deep Energy Retrofits

Anastasia Herk
IBACOS

Goals of Research Project:

- Evaluate cost and performance trade offs between:
  - Spray-foam exterior walls
  - Foamboard exterior walls
  - Home Performance with Energy Star Home (HPwES) on steroids
- 50% peak load and annual heating load reduction
- R-30Target for Center of Wall
- .25 CFM50 per shell SF
- $10/ssf (Shell sq ft) insulation strategies
- 20% minimum contribution from homeowners

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Assumptions about the Homeowner:

- Homeowner has an older house so they were already going to re-side and possibly install new windows
- This could lead to other energy upgrade opportunities:
  - HVAC
  - Air sealing
  - Windows
  - Insulation
  - Water heating

Project Partners

Manufacturers, Contractors, NYSERDA, Engineers

Bayer MaterialScience

SIMPSON

Strong-Tie

DOW

Johns Manville

Carrier

urn to the experts

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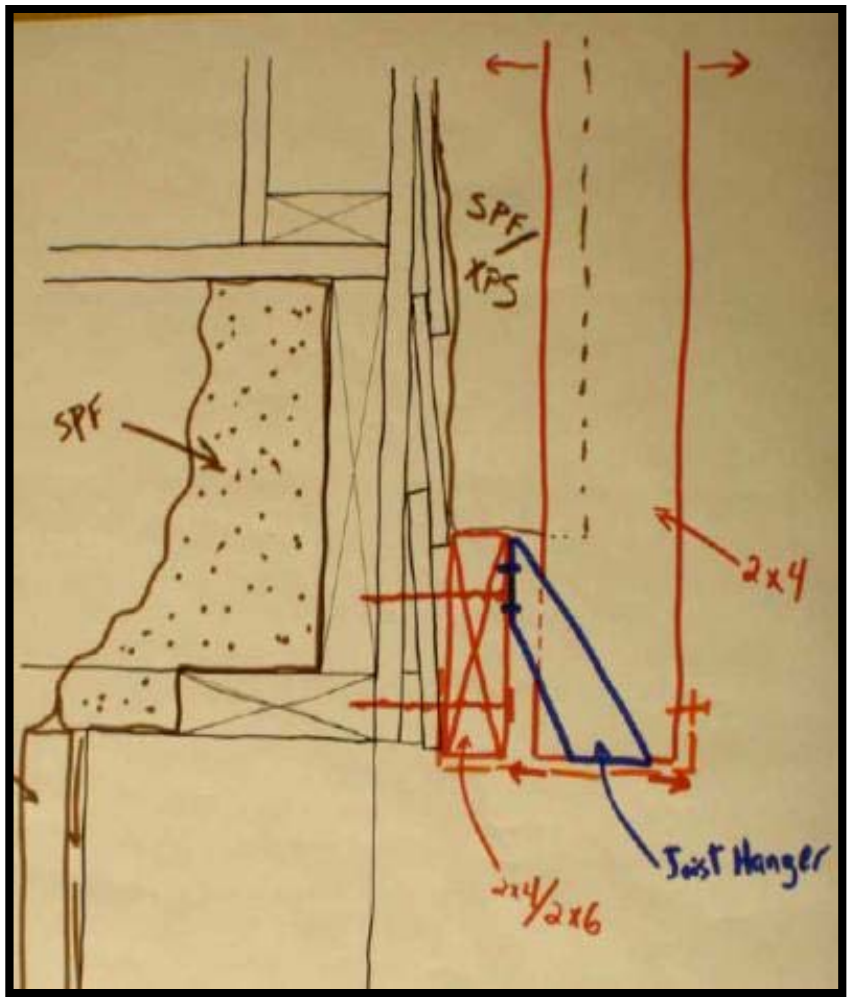
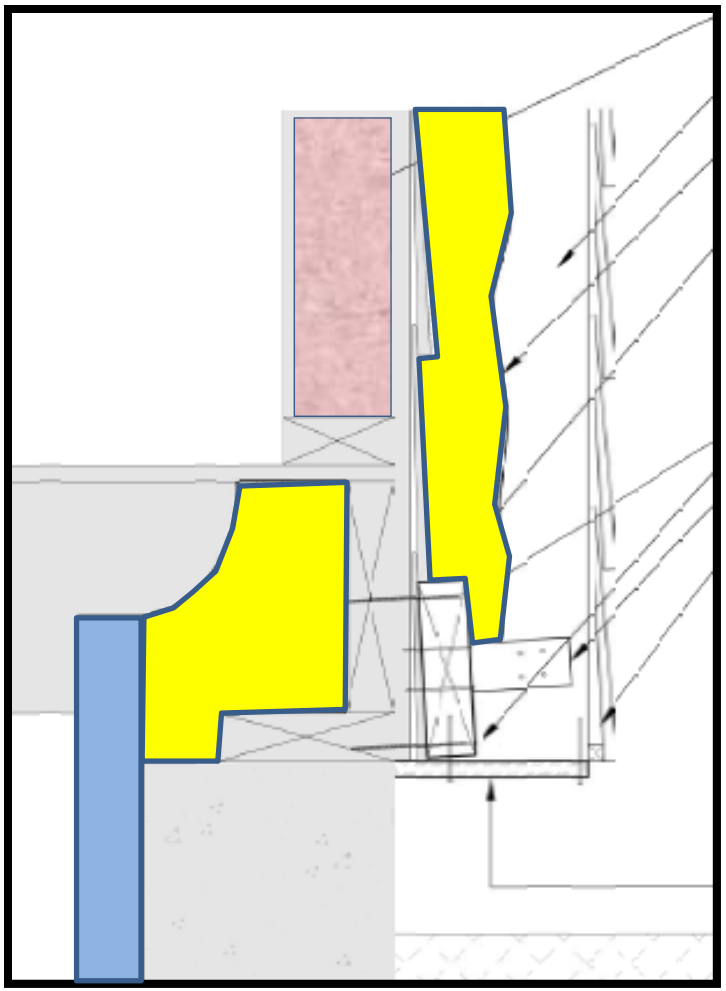
Why do this?

- Why cover existing siding? :
  - Minimize need for disturbing existing construction that includes lead paint
    - Spray foam encapsulates the paint.
  - Allows for re-skinning building without having to remove existing siding

- Why use spray foam?:
  - Spray foam is an integral insulation, air sealing and draining plane material in one application
  - No taping and flashing like you would with rigid

Brainstorming Ideas: Bottom of Wall





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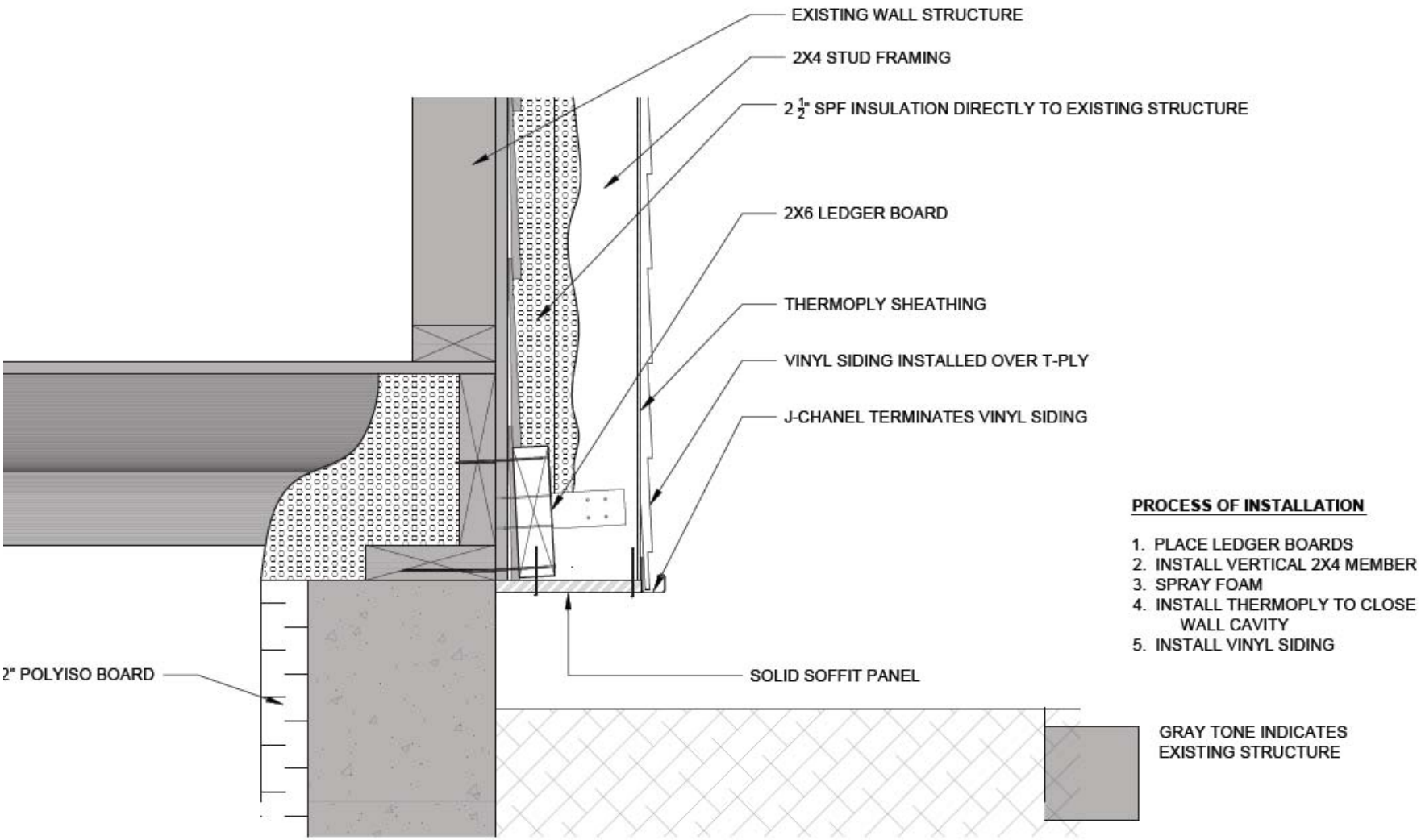
First House Construction Detail: Bottom of Wall



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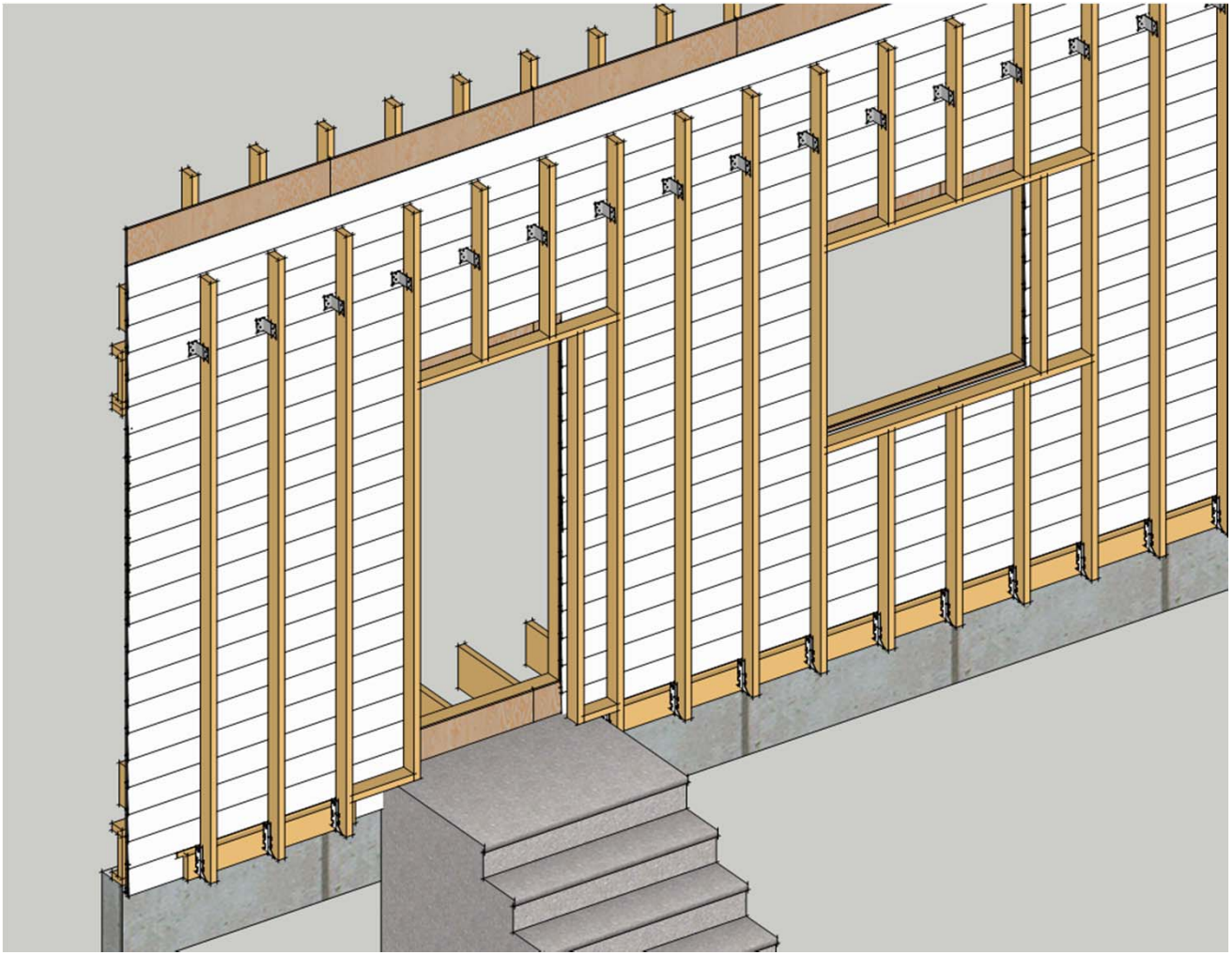
Initial concept



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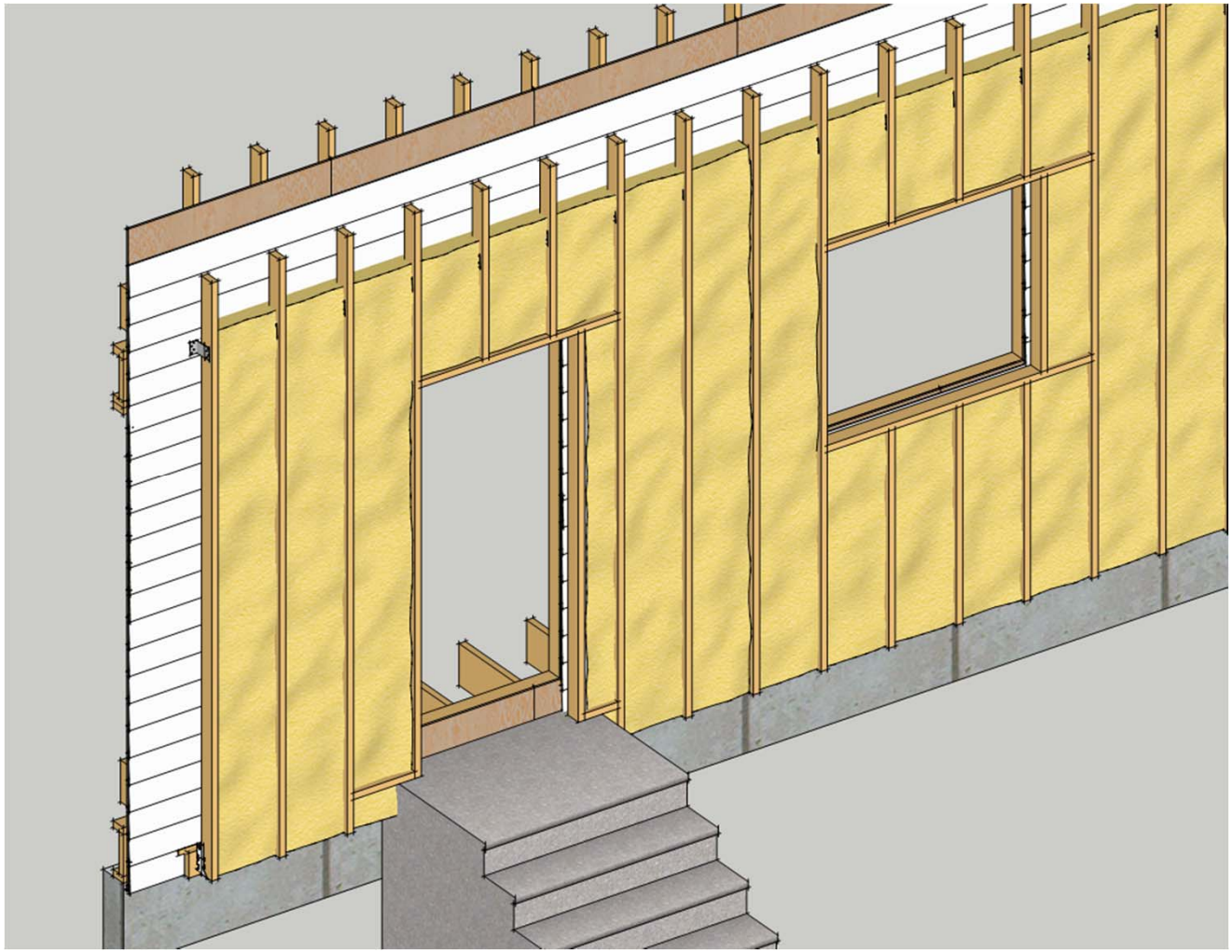
Initial concept



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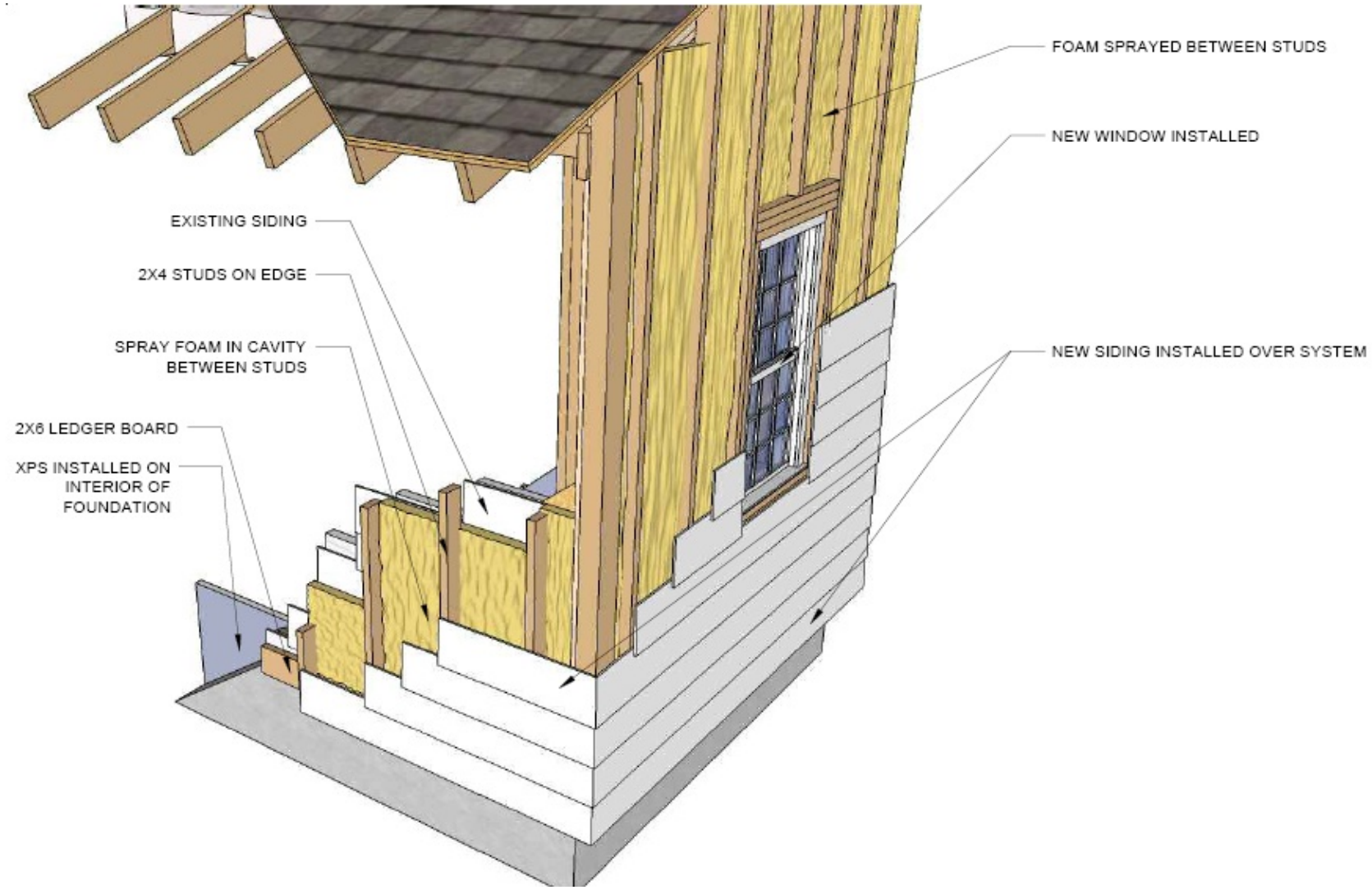
Sketchup Ideas



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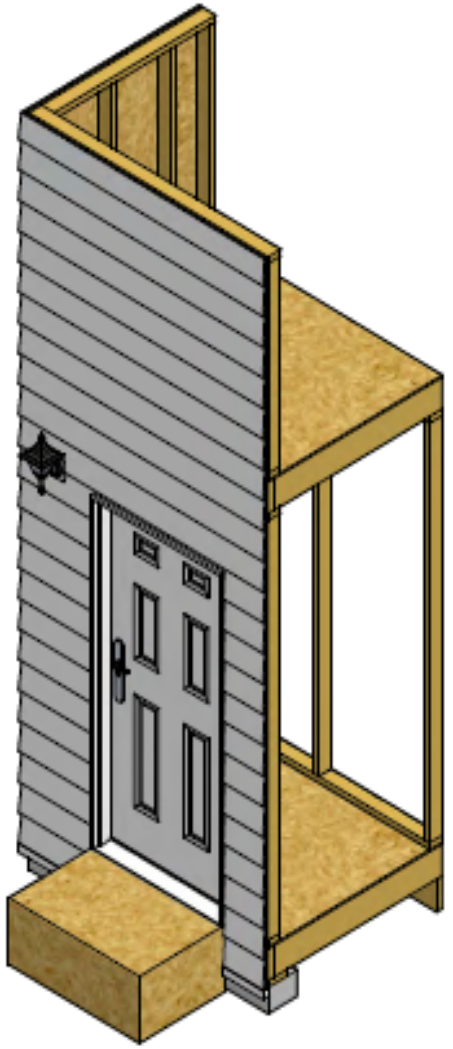
Mockups: Door/ Electrical/ 1st-2nd Floor

- 2-Story
- Rim/band Joist Detail
- Rim/band Joist Attachment
- Door Frame Detail
- Electrical Detail



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Mockups: Window Details/ Top of Wall

- New Wall to Roof Detail
- Window Installation Detail
- Top of New Wall Detail
- Exterior Corner Detail
- Electrical Detail

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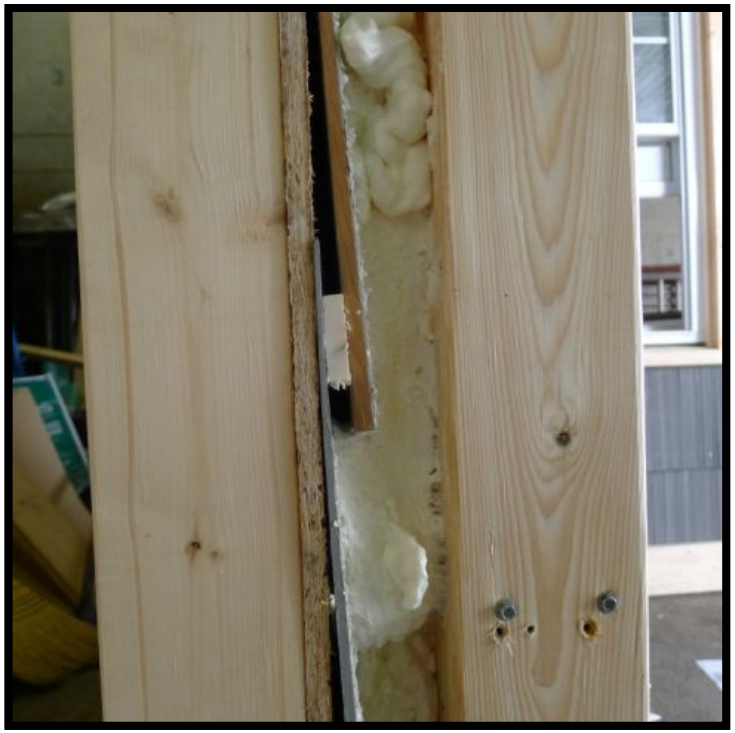
Mockups: Window Details/ Top of Wall



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Test House: Existing Condition

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New wall framing

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Front of home

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Installation of Spray Foam

New Wall Intersection at Roof

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New Wall with Full Insulation

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Installation of Thin Profile Structural Sheathing and New Siding

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Test House: Final

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Air Sealing Improvements

Improvement Stage	CFM50	CFM50 Reduction from Start	% Reduction from Start	ACH50	CFM50/SSF
Start	2675	0	0%	8.8	0.40
Air Seal Attic	1925	750	28%	6.3	0.29
Wall Build-Out (Including Windows and Foam)	1800	875	33%	5.9	0.27
Spray Foam Band Joist/ERV Installed	1625	1050	39%	5.4	0.25
Air Sealing Between Basement and First Floor	1590	1085	41%	5.2	0.24

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Peak Load Reductions:

	Test House			
Location	Pre Retrofit BTUH		Post Retrofit BTUH	
	Heat	Cool	Heat	Cool
Basement	15141	2988	13890	2547
Living Room	12714	6858	2998	2222
Dining Room	3834	1899	264	103
Kitchen	6034	3691	1828	1701
Study/ Office	4322	1801	726	237
Master Bedroom	7009	4097	1488	1398
Bedroom 1	5931	2546	1199	502
Bath	1187	520	198	29
TOTALS	**56,172**	**24400**	**22591**	**8739**

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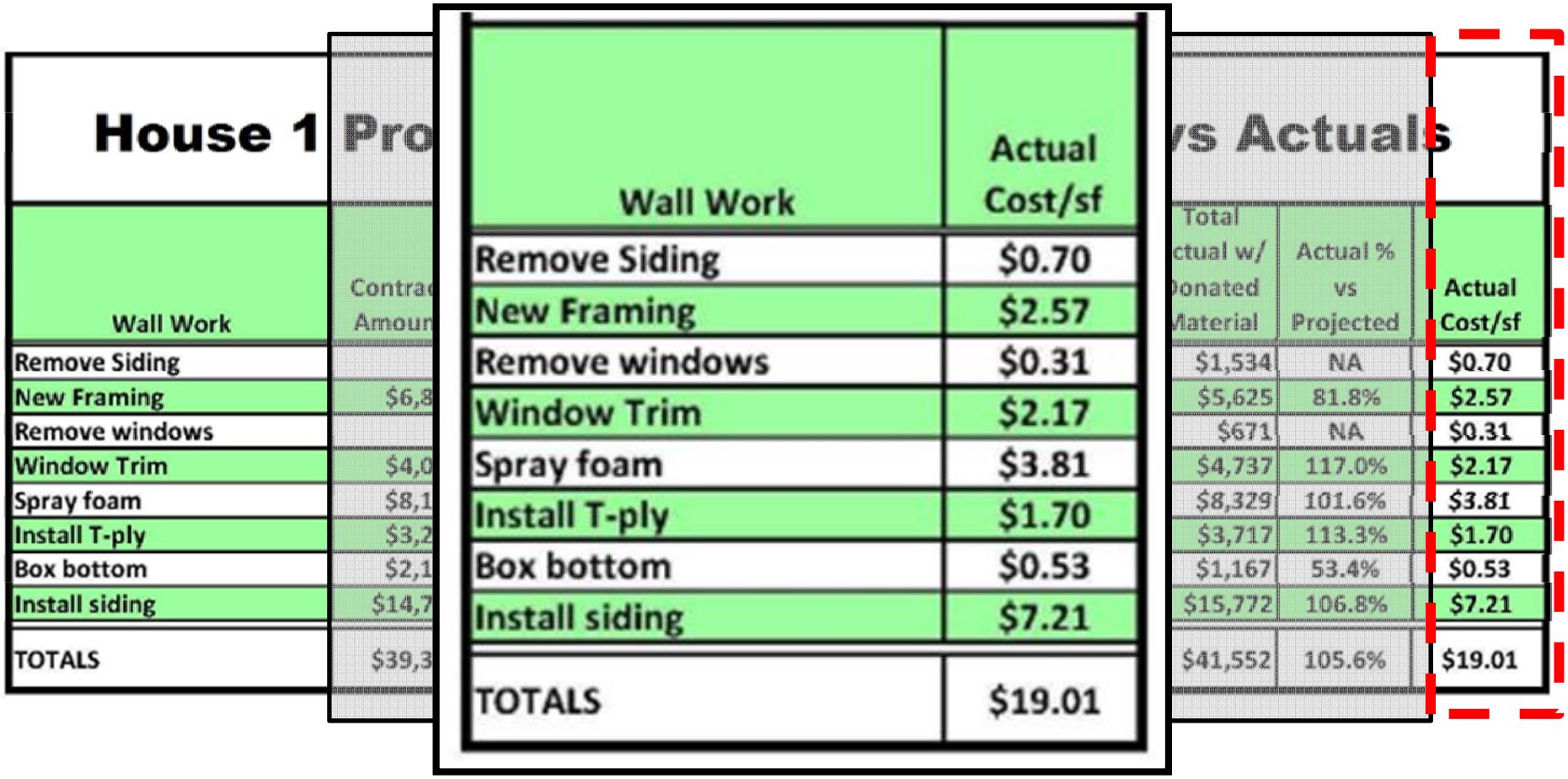
Test House: Costing



House 1 Pro ... vs Actuals

Wall Work	Contrac Amoun	Wall Work	Actual Cost/sf	Total ctual w/ Donated Material	Actual % vs Projected	Actual Cost/sf
Remove Siding		Remove Siding	$0.70	$1,534	NA	$0.70
New Framing	$6,8	New Framing	$2.57	$5,625	81.8%	$2.57
Remove windows		Remove windows	$0.31	$671	NA	$0.31
Window Trim	$4,0	Window Trim	$2.17	$4,737	117.0%	$2.17
Spray foam	$8,1	Spray foam	$3.81	$8,329	101.6%	$3.81
Install T-ply	$3,2	Install T-ply	$1.70	$3,717	113.3%	$1.70
Box bottom	$2,1	Box bottom	$0.53	$1,167	53.4%	$0.53
Install siding	$14,7	Install siding	$7.21	$15,772	106.8%	$7.21
TOTALS	$39,3	TOTALS	$19.01	$41,552	105.6%	$19.01

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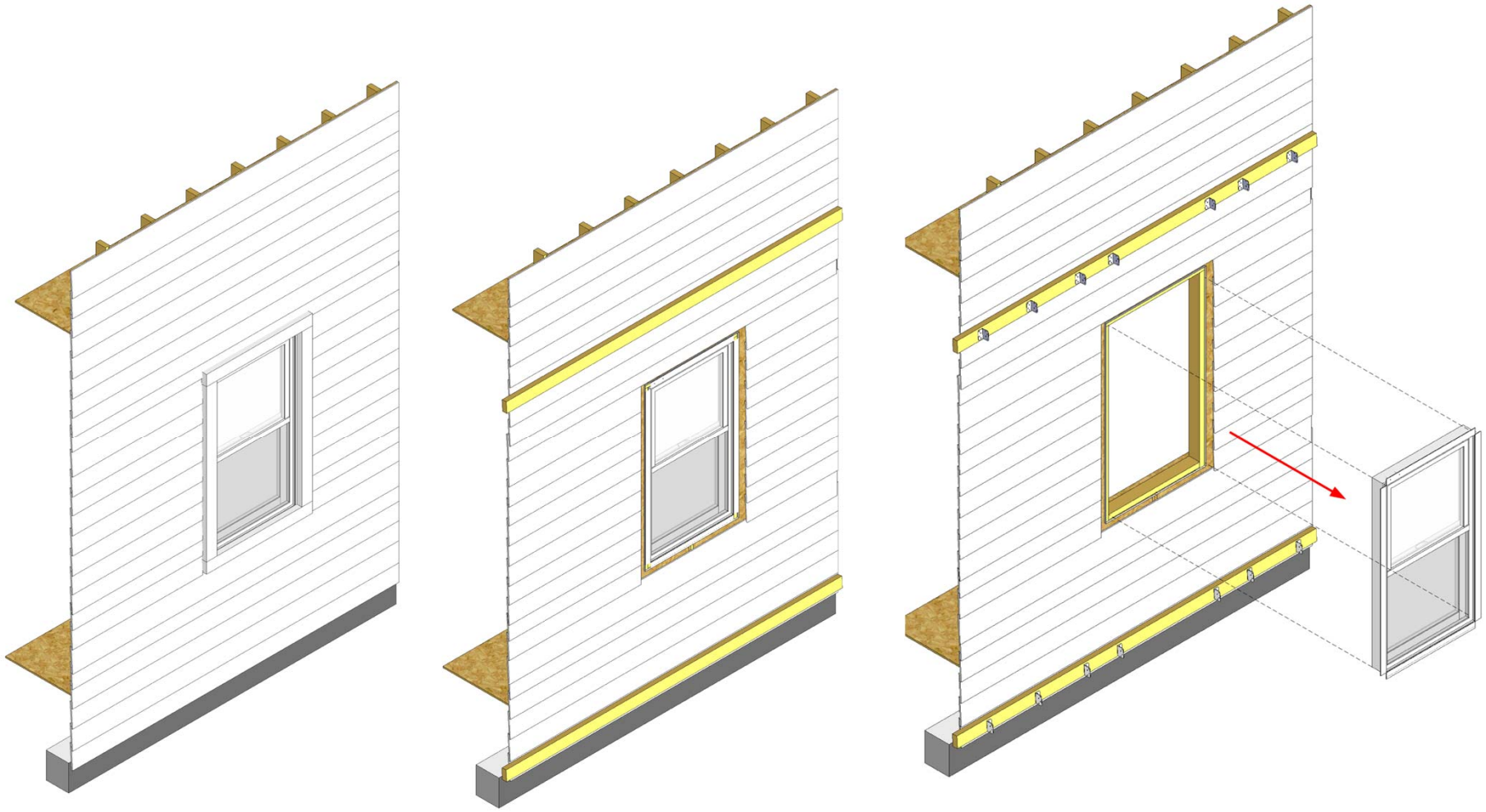
Test House: Lessons Learned

- ✓ Installation of Ledger Boards
- ✓ Brackets and Spray Foam
- ✓ Extending timing with construction
- ✓ Permitting process
- ✓ Order of installation
- ✓ The challenge of staging construction for testing
- ✓ Integrating utility logistics

Step-by-step Installation Process



Step 1

Step 2

Step 3

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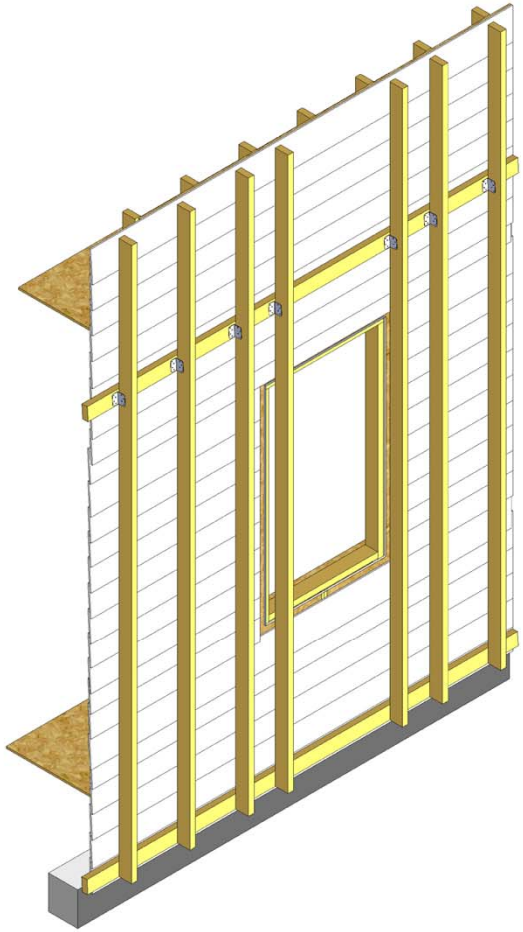
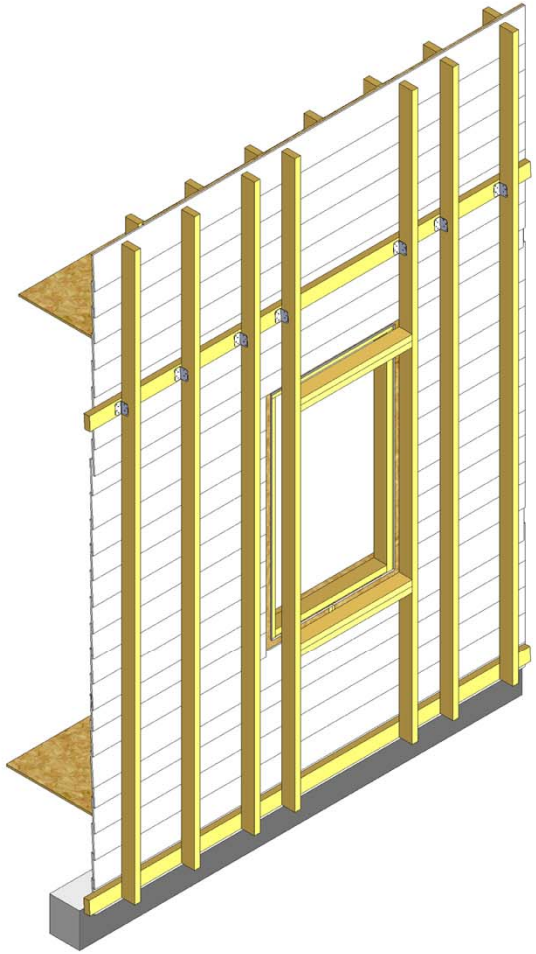
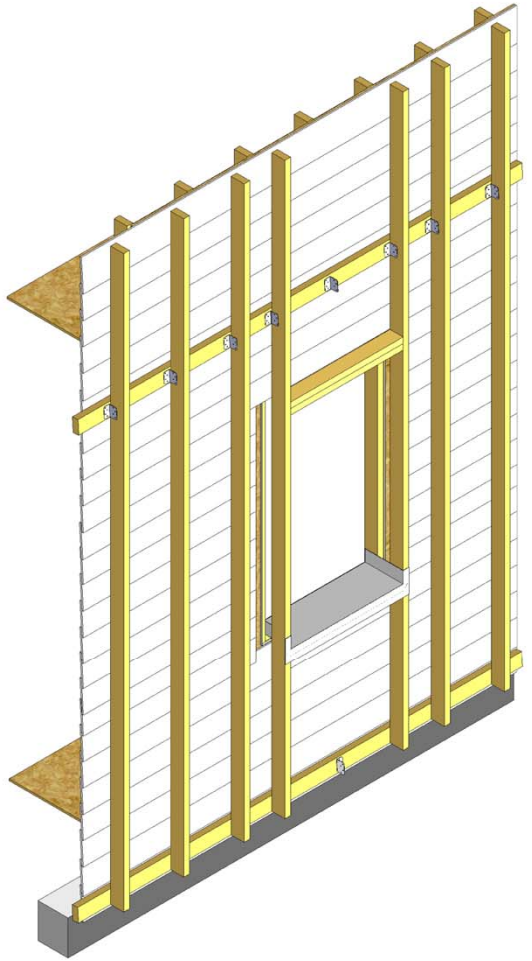
Step-by-step Installation Process



Step 4



Step 5



Step 6

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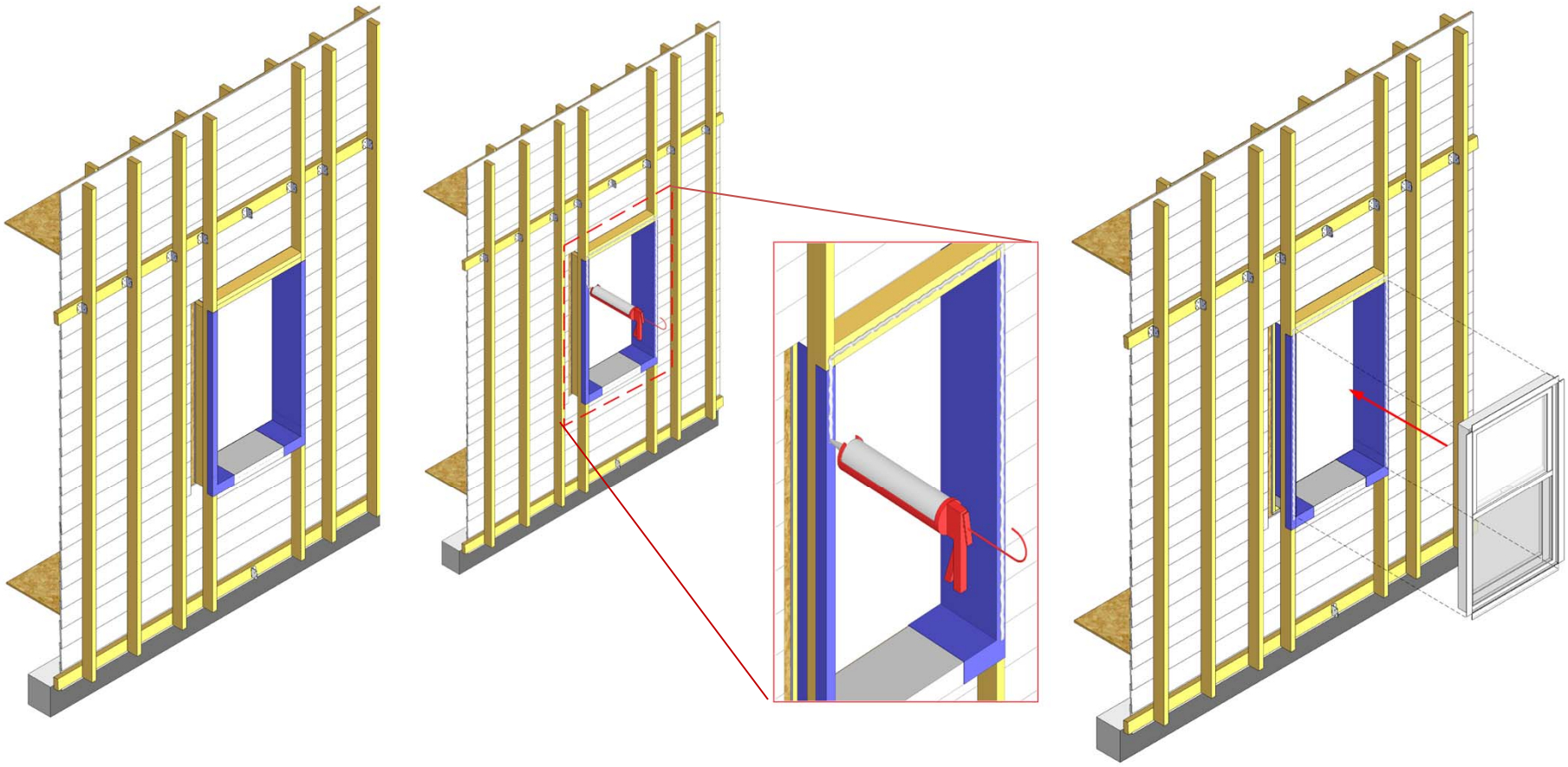
Step-by-step Installation Process



Step 7

Step 8

Step 9

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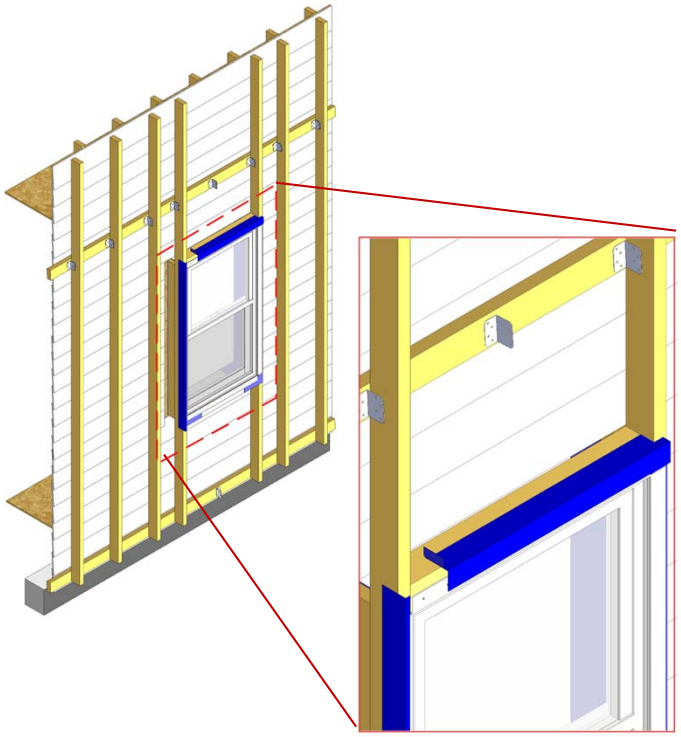
Step-by-step Installation Process



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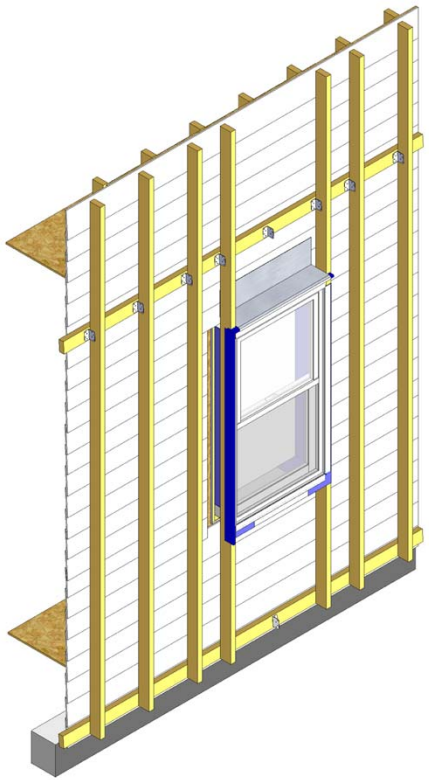
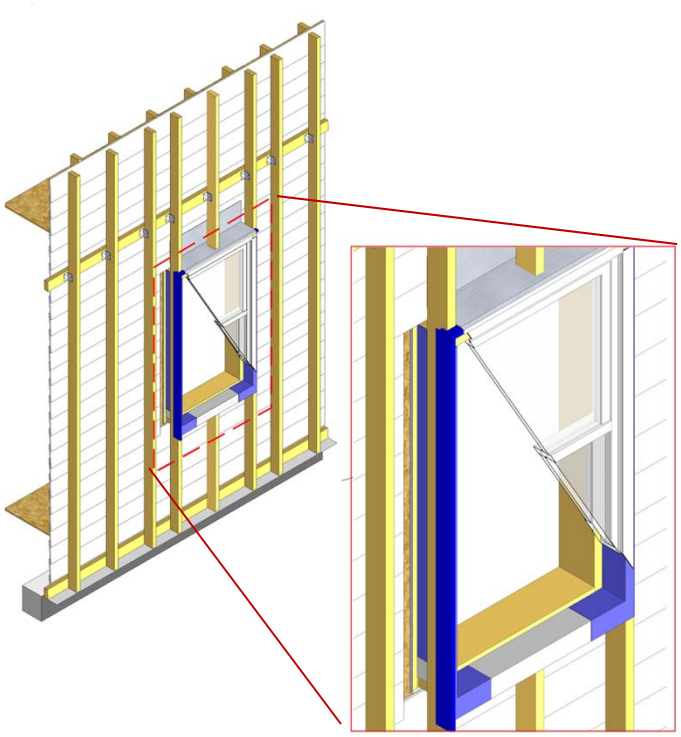


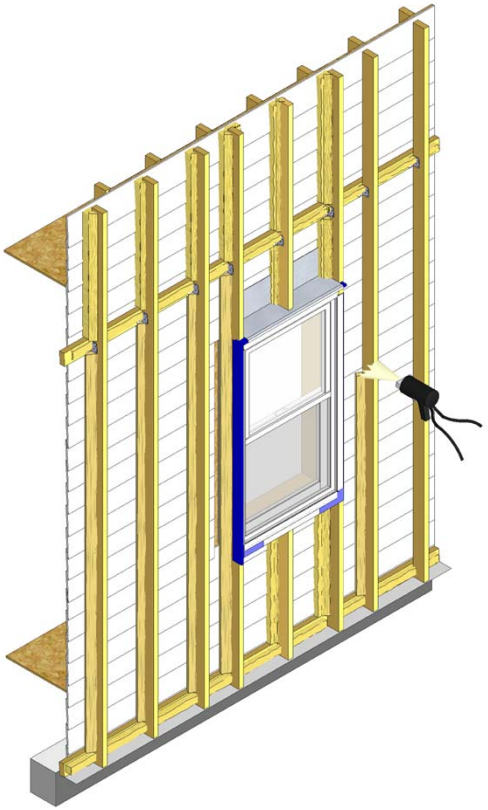
Step 11



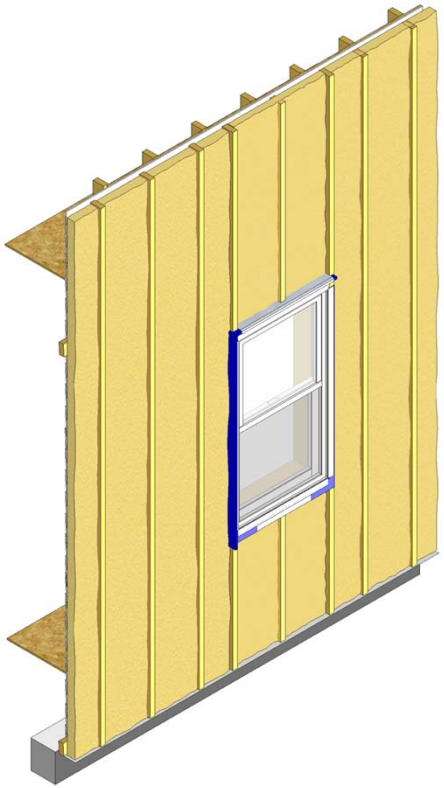
Step 12

Step-by-step Installation Process

Note: Some siding profiles may require thin profile structural sheathing



Step 13



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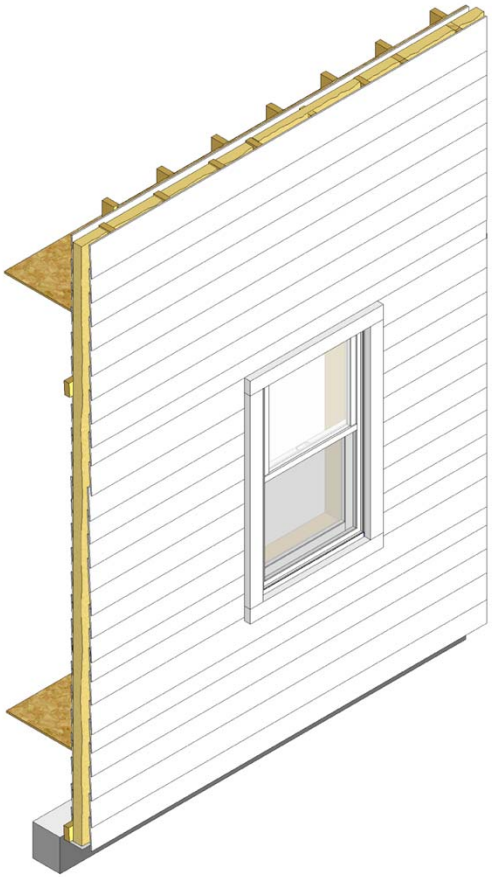

Step 15

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